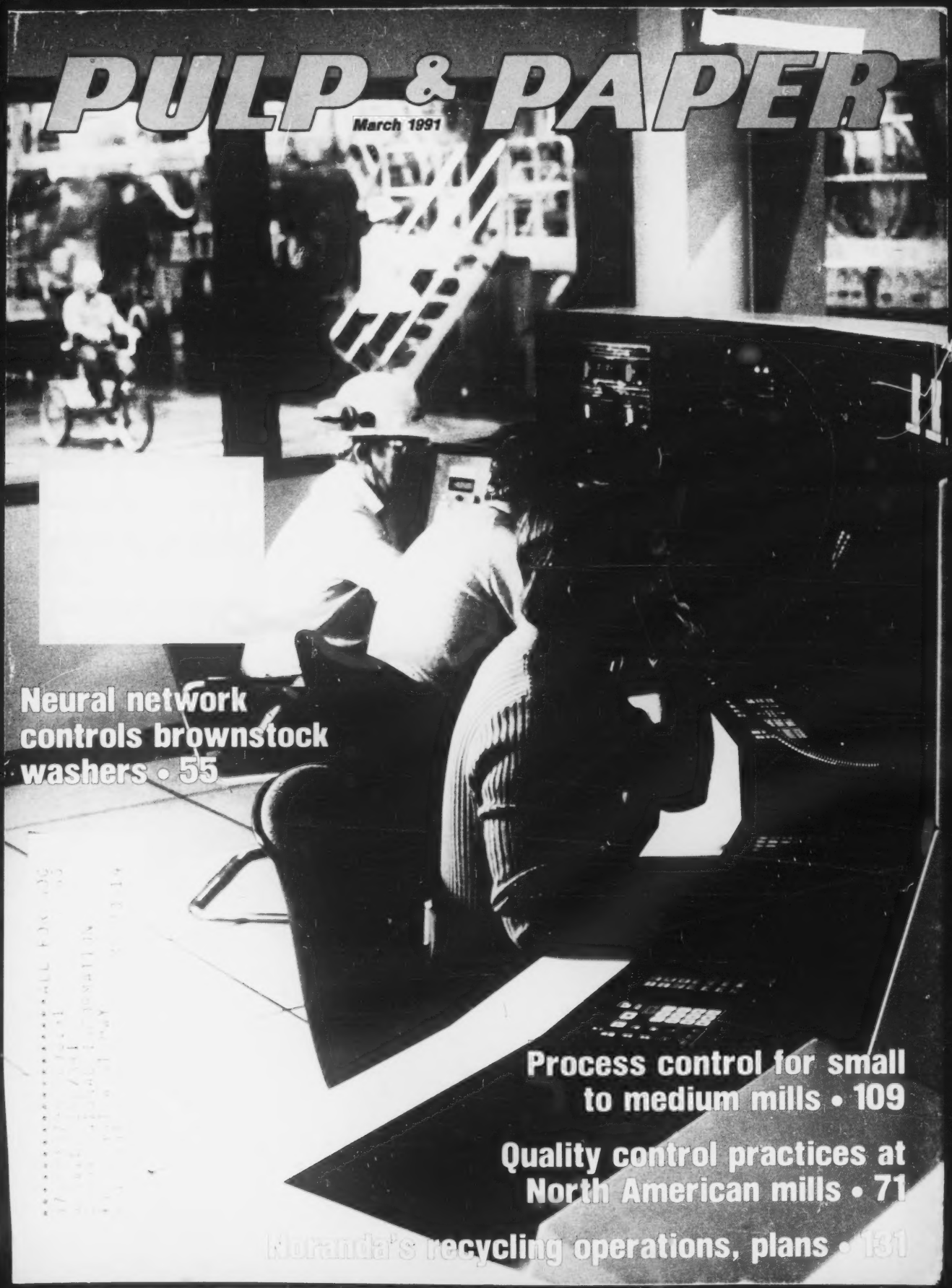
PULP & PAPER

March 1991



Neural network controls brownstock washers • 55

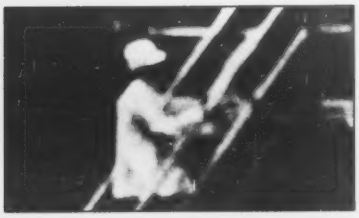
Process control for small to medium mills • 109

Quality control practices at North American mills • 71

Noranda's recycling operations, plans • 131

Volume 65
Number 3

MARCH



FOCUS: PROCESS AUTOMATION

Neural network control 55
Artificial intelligence system maintains uniform solids levels in pulp and paper mill's first-stage brownstock washer filtrate

Finch Pruyn power plant 69
Lap-top PC provides real-time screen display of plant data from across the hall or across the country, wherever a telephone is available

Caledonian Paper 82
Scotland's LWC mill minimizes short-term paper machine variation to enhance product quality with runability monitoring system

NEW PRODUCT ROUNDUP ▸ 85

Pulp & Paper's special section highlights latest control products, equipment, and services for the pulp and paper industry; booth numbers are included for companies exhibiting at the TAPPI Process Control Conference in Orlando, Fla., Mar. 3-7

Process automation outlook 109
Advanced control packages will help mills that didn't modernize in the late 1980s remain competitive in the 1990s

Rigid sensor platform 124
Liquid-cooled system at Lincoln Pulp & Paper is immune to thermally induced warping, improving consistency, accuracy of measurements

FOCUS: QUALITY CONTROL

Quality standards 59
ISO 9000 series standards require all companies selling into the European market to have a documented quality system

Quality control survey 71
North American pulp and paper mills are reacting to customer demands, tighter markets with implementation of major quality control programs

Quality control toolbox 120
First in a series of articles on developing an SPQC program for management and operators at pulp and paper mills

THE COVER

This issue's focus on process automation reports on some of the latest high-tech control equipment in use at pulp and paper mills worldwide and includes an analysis of how mills can improve process efficiency through economical control improvements (p. 109). **(Photo of paper machine control room courtesy of Domtar Inc. and Honeywell.)**

FEATURES

RECYCLING

Fine paper recycling 131
Noranda Forest Recycled Papers increases collection and expands Thorold mill to meet new Canadian postconsumer wastepaper standards

PAPERMAKING

Single-felted drying 134
Three European mills use a new single-felted dryer section to improve runability, enhance paper quality on their high-speed paper machines

ENGINEERING/MAINTENANCE

Document restoration 123
Bowater's Southern Div. in Calhoun, Tenn., cleans up its old mechanical drawings using advanced restoration and scanning technology

WOODYARD

MOTAG-North meeting 114
New chip screening processes are introduced, deicing/drum debarking of longwood is discussed, and a woodyard is profiled

Chip screening 140
Small disc screen retrofitted ahead of V-screen can dramatically improve efficiency and extend operating life

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MARCH

COLUMNS

From the Editors 7
by Ken L. Patrick
Monsters bad for industry image—Part II

Career Development 41
by Roberta Bhasin
How not to succeed

Maintenance Management 43
by Christer Idhammar
World-class pulp and paper maintenance

Quality Report 149
by Lars Ingman
The quality infrastructure

Comment 194
by Con H. Schallau
The state of timber supply

DEPARTMENTS

Conference Calendar 45
News of People 157
Product Showcase 164
New Products 166
Product Review 171
Bookshelf 172
Letters 172
Supplier News 174

SERVICES

Reader Service Review 160
Reader Service Card 161
Professional Service Directory 180
Classified Advertising 182
Advertisers Index 192

NEWS

Month in Statistics 9
U.S. paper and paperboard production data for December

Market Report 11
U.S. linerboard prices decline
Postal strike hits coated paper markets
Buyers resist multiwall price hike

Grade Profile 13
Coated free-sheet: Markets suffer from overcapacity, economic dubiety

NEWS SCAN

Newsprint price hike on the fence 25
Recycled newsprint capacity up 27
Abitibi gets grant for plant 27
Scott to divest Westbrook mill 27
G-P finishes restructuring 29
Orenda adds MFC paper to project 29
Pope & Talbot plans Halsey project 31
Strikers return to mill 31
Abitibi mill could be closed 31
WTD seeks bankruptcy protection 31
Purchase bid for mill withdrawn 33
New recycled mill proposed 33
Stone plans downtime 33
Four M buys Service Container 33
Chesapeake sells Philly plant 35
Smurfit to upgrade plant 35
Environmental mishaps add up 35
How bad is dioxin? 35
G-P sells Reading, Pa., mill 35
Forest management pacts set 37
Westwood takes over routes 37
Pollution standards delayed 37
American papermaking exhibit 37
History of papermaking exhibit 37

International News 39
Portugal opposes Stora stake in mill
Czechs, Norwegians plan SC machines
ECC probes fax paper dumping
Finland's big-three announce project

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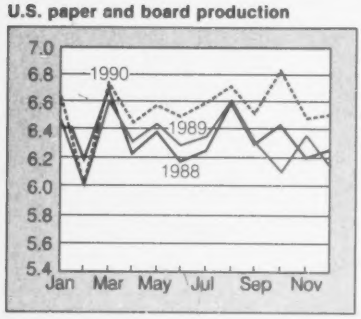
ABP

BPA

U.S. paper and board production



U.S. production of paper and paperboard totaled 6.5 million tons in December, up 5.8% from a year earlier, according to the American Paper Institute, bringing the total for 1990 to a record 78.6 million tons, an increase of 2.4% over 1989. Paper production outpaced paperboard all year long, finishing the year up 3.0% to 39.4 million tons. The peak months for paper production were July through October, when mills produced at an annual rate of 39.8 million tpy, API reported. In contrast to paper, paperboard strengthened at the end of the year, raising total output to 39.2 million tons, up 1.8% from 1989.

Among major grades, newsprint showed strong year-over-year growth thanks to newly installed paper machines, but downward trending consumption cut into output late in the year. Printing and writing paper finished the year up 3.5% over 1989 to a record 22.4 million tons, despite weakness in December.

Canadian newsprint shipments totaled 740,000 metric tons in December, bringing the yearly total to 9.1 million tons. Operating rates dropped to 86%, bringing the yearly rate to 90%. Woodpulp shipments dropped 8% for the year to 7.7 million tons, with operating rates dropping to 84% of capacity. ■

	Latest month (000 short tons)		% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION[1]					
Newsprint	Dec.	576	8.3	6,615	8.7
Uncoated groundwood (s)	Dec.	147	19.5	1,768	1.4
Coated paper (s)	Dec.	564	-3.6	7,521	4.2
Uncoated free-sheet (s)	Dec.	930	7.6	11,510	3.9
Other printing/writing	Dec.	121	8.0	1,583	6.0
Total packaging and other paper (s)	Dec.	359	-10.7	4,611	-6.2
Tissue	Dec.	484	5.2	5,802	2.9
Total paper	**Dec.**	**3,183**	**3.4**	**39,410**	**3.0**
Unbleached kraft paperboard	Dec.	1,795	14.5	20,335	4.3
Semichemical medium	Dec.	494	2.9	5,710	0.3
Bleached paperboard	Dec.	369	-0.8	4,380	-3.1
Recycled paperboard	Dec.	683	4.8	8,731	-0.3
Total paperboard	**Dec.**	**3,321**	**8.1**	**39,156**	**1.8**
Total U.S. paper and paperboard output	**Dec.**	**6,504**	**5.8**	**78,566**	**2.4**
PULP, WASTEPAPER & FIBER[2]					
Total U.S. woodpulp production	Nov.	5,150	2.6	63,205	1.6
Market pulp production	Nov.	674	-2.2	8,817	0.8
Wastepaper consumption at paper/board mills	Nov.	1,790	6.9	21,212	8.4
Pulpwood consumption (cords)	Nov.	8,120	0.6	99,379	0.7
CONVERTED PRODUCTS STATISTICS[3]					
Corrugated box shipments (billion ft²)	Dec.	21.412	-7.7	315.775[6]	0.8
Containerboard inventories at U.S. box plants and mills	Dec. 1	2,526	3.1		
INTERNATIONAL TRADE[2]					
U.S. paper imports (including products)	Nov.	1,090	-0.9	13,111	1.0
Imports of Canadian newsprint	Nov.	668	-5.8	8,187[6]	-2.0
U.S. paper exports (including products)	Nov.	546	14.9	8,833	8.6
Exports of unbleached kraft linerboard	Nov.	174	10.8	2,604	18.2
Exports of woodpulp	Nov.	438	26.2	5,922	-3.9
Norscan pulp inventories[4]	Dec. 31	1,359	33.1		
Norscan pulp operating rates[4]	Dec.	82%	82%	87%	87%
CANADIAN STATISTICS[5] *(reported in metric tons)*					
Total newsprint shipments	Dec.	740	-9.4	9,075[6]	-5.5
Operating rates	Dec.	86%	94%	90%	96%
Inventories held by U.S. consumers	Dec. 31	1,226	3.9		
Other paper/board shipments	Dec.	535	3.7	7,393	6.9
Woodpulp shipments (export only)	Dec.	660	-11.8	7,686	-7.9
Operating rates	Dec.	76%	84%	84%	93%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fibre Box Assn., Paperboard Packaging Council 4. North American/Scandinavian paper-grade market pulp. 5. Canadian Pulp & Paper Assn. 6. Not annualized. (s) = Shipments.

Coated free-sheet: Markets suffer from overcapacity, economic dubiety

Grade structure: Paper with less than 10% mechanical pulp is designated as coated free-sheet. The highest grades, Nos. 1 and 2, contain no mechanical pulp, though Nos. 3 and 4 may or may not contain some mechanical fiber.

Most coated free-sheet is coated two-side (C2S) paper used for magazines, catalogs, advertising brochures and inserts, and other commercial printing. Coated one-side (C1S) paper has remained about 13% of total coated free-sheet production. Most C1S paper is used for labels, with some used in books, commercial printing, business forms, envelopes, and converted products other than labels.

Nos. 1 and 2 generally range from 60 to 100 lb and Nos. 3 and 4 in basis weights of 25 to 90 lb. Some 85% of coated paper has a glossy surface, the rest, a combination of dull, matte, and embossed. Gloss finishes on the Gardner glossmeter are 45 or more for glossy, down to 25 for dull, and 20 or below for matte. Two-thirds of No. 1 is glossy, 25%, dull; No. 2 is 80% glossy and 16% dull; and No. 3 is almost two-thirds glossy, one-third matte, and about 3% dull. Embossed is less than 2% of any grade.

In 1990, No. 1 paper represented about 14% of U.S. coated free-sheet production. No. 2 was 19%, No. 3 about 28%, No. 4 about 18%, and No. 5 near 7%. Only a few Canadian mills produce coated free-sheet, primarily Abitibi-Price Inc.'s Provincial Papers in Thunder Bay, Ont., which is under threat of closing down. Repap Enterprises Corp. Inc. does have a swing machine in New Castle, N.B.

Production/capacity: U.S. capacity of coated free-sheet was due to rise almost 11% in 1991, to over 4 million tpy, and 9% in 1992, the American Paper Institute said. The following new projects came online in 1990-91: Champion International Corp.'s 265,000-tpy machine in Quinnesec, Mich.; Scott Paper Co.'s 215,000-tpy machine in Skowhegan, Maine, and 60,000-tpy speedup at Muskegon, Mich.; Consolidated Papers Inc.'s 212,000-tpy in Wisconsin Rapids, Wis.; and Westvaco Corp.'s 250,000-tpy coated conversion at Wickliffe, Ky.

Canadian capacity will increase 10% this year to 165,000 metric tpy and another 9% in 1992, the Canadian Pulp & Paper Assn. reported. Island Paper Mills Co.'s off-machine coater will add 83,000 short tpy at New Westminster, B.C., by 1994.

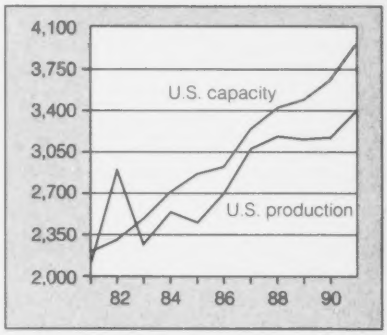
Outlook: No. 1 growth will be about 12%/year through 1998. No. 2 will increase coated market share to nearly 5%. No. 3 will grow 5.7% annually. Demand for No. 4 free-sheet will increase faster than for No. 4 groundwood. Nos. 1, 2, and 3 grades will experience strong growth. European producers have also entered the market; they currently supply about 8% of total U.S. demand for Nos. 1 and 2 and the superpremium grades.

Use of recycled fibers for coated free-sheet paper is still severely limited, though Westvaco Corp. has introduced a grade and another is possible from Simpson Paper Co.'s West Linn, Ore., mill.

Markets: Commercial printers used about 70% of coated free-sheet paper in 1990, followed at 12% by magazines, 11% for labels, 6% for books, and less than 1% each for business forms, other converting, and export. End uses include annual reports, catalogs, other advertising and promotional materials, and cover and interior pages of upscale magazines, with some used in coffee table books.

Prices: Historical pricing trends ($/short ton, average price for year) for coated free-sheet are as follows for 70-lb No. 1 sheets: 1986, $1,350; 1987, $1,410; 1988, $1,509; 1989, $1,614; 1990, $1,610. The following are historical prices for No. 3 rolls: 1986, $945; 1987, $980; 1988, $1,115; 1989, $1,258; 1990, $1,270. ■

SUPPLY/DEMAND (000 tons)



FORECAST (000 tons)

U.S.	1989[1]	1990[1]	1991e
Production[2]	3,155	3,157	3,409
Capacity[3]	3,503	3,638	4,023
Utilization rate	90.1%	86.8%	84.7%
Imports	235	276	288
Exports	51	77	85
Apparent U.S. consumption	3,339	3,356	3,612
lb/capita	27.00	26.85	28.61
GNP ratio (1982)	0.81	0.81	0.86

e = Estimate.
1. Revised.
2. *Pulp & Paper* estimates.
3. API.

TOP NORTH AMERICAN PRODUCERS

	Annual capacity (000 tons)	Market share (%)
1. Scott Paper[1,2]	1,100	26.2
2. Westavco[2,3]	590	14.0
3. Champion International	510	12.1
4. Mead	382	9.1
5. Consolidated Papers[2]	380	9.0
6. Repap Enterprises	334	7.9
7. Potlatch	310	7.4
8. Simpson Paper[2]	274	6.5
9. Noranda Forest	170	4.0
10. Abitibi-Price[4]	100	2.4

Market share of top five companies:
65.7%

Market share of top ten companies:
98.7%

North American capacity (1991):
4,205 million tons

Canada:
182,000 short tpy

1. S.D. Warren Div.
2. *Pulp & Paper* estimate.
3. Some potential coated capacity is unused.
4. Provincial Papers currently operates two machines.

Customer Demands, Tighter Markets Drive Mills' Quality Control Efforts

Survey of North American pulp and paper mills shows programs are in early stages, but most mills are involved in major improvement efforts

By KELLY H. FERGUSON, Projects Editor

Quality control—as defined by Deming, Juran, Crosby, et al.—seems to be taking hold in North American pulp and paper mills, even though most mills are in the early stages of implementation and are still battling to refine their programs and gain support from upper management. These quality programs, or "systems" as some mills refer to them, are being implemented at a time when most industry analysts say that competition in most markets is fierce and paper companies are beginning to sell to a global marketplace.

For companies selling in foreign markets, some type of quality system for the papermaking process may be necessary due to the integration of quality standards from various European countries into the ISO-9000 standards (see discussion, p. 59). Competition in the domestic markets is also helping push mills toward some type of structured quality program, which will improve process efficiency and product quality and enable them to provide customers proof of a superior product.

A *Pulp & Paper* survey of quality control practices shows that North American pulp and paper mills are seriously investing time and effort into quality control but are still in the early stages, as yet unable to involve mill operators 100%. It is at this level, quality "gurus" say, that the investment begins to pay off.

The *P&P* survey covered a wide range of North American mills: 25 U.S. states and six Canadian provinces; 15 grades of pulp, paper, and board; and tonnages from 26,000 tpy (smallest) to 882,000 tpy (largest). The respondents' titles were mostly in the quality control or technical area, although some mill general managers and process engineers responded.

INDUSTRY EMPHASIS ON QUALITY. Quality improvement and product consistency programs take various forms depending on the mill, its management, and its philosophy. A majority of responding mills (81%) said they have some type of active, ongoing quality program.

Of those mills that have implemented a quality program, many use a combination of methods on which to base their programs. Statistical process control/statistical quality control (SPC/SQC) (43.5%) and quality improvement teams (43.5%) are the methods most chosen. Total quality management (TQM) systems are used by 23%, and quality circles are used by 10%. Other methods employed include process tracking charts, databases for statistical analysis, and a Tennessee Associates International program termed "Managing for Consistency." Again, most mills use a combination of these programs; therefore, these percentages would not equal 100%.

Although quality control and improvement is certainly not new, pulp and paper mills seem to have just begun putting specific programs in place. Asked when their quality programs were implemented, most mills (44%) indicated the 1980s, and 17% said the 1990s. Only 4% said the 1970s. The other 35% either had no specific program or gave no date of implementation (Figure 1).

In developing their program or system, most mills take the initiative without the assistance of consultants or vendors—54% said they developed their program in-house only. Consultants do play a fairly major role in program development, though, usually in combination with mill personnel. Mill/consultant teams were used by 15% of the mills, and 6% of the programs were devel-

FIGURE 1: **Active, established quality control programs seem to just be catching on in the pulp and paper industry—most of the mills have implemented their programs in the last ten years, and most of those were in the latter part of the 1980s.**

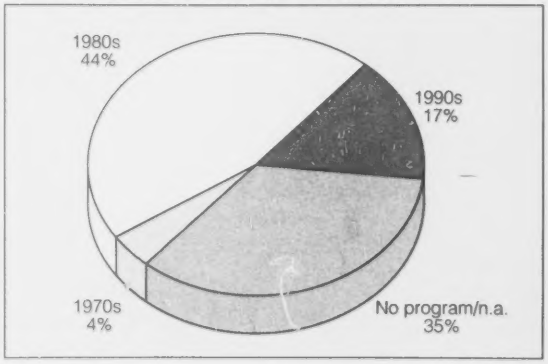
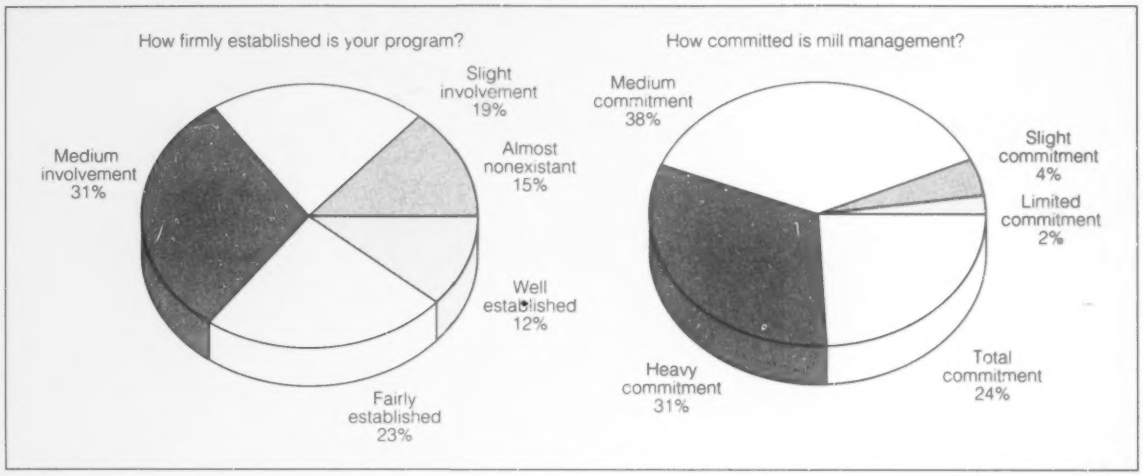


FIGURE 2: **Asked to rank their mills (on a scale of one to five) on how firmly established the quality programs are, respondents showed not only how new most programs were with indications of medium involvement but also that commitment from mill management is fairly high.**



oped by consultants only. Other programs were developed by various teams, including mill/corporate, mill/corporate/consultant, corporate, corporate/consultant, and mill/vendor.

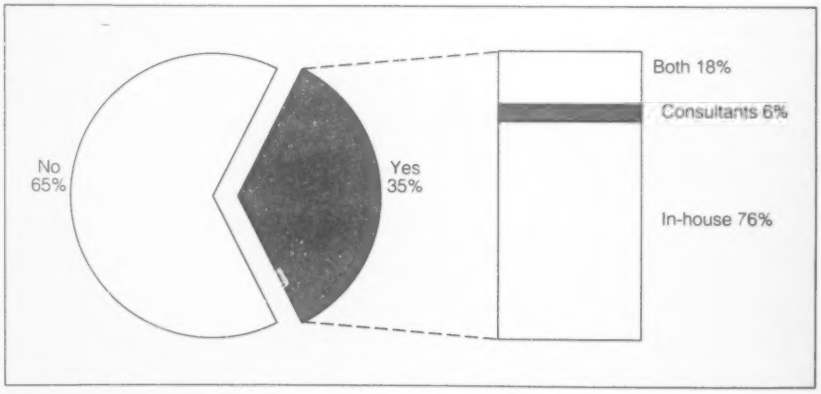
One of the best indicators of how a quality program will succeed at a mill is the support management gives the program as viewed by the mill employees. Respondents were asked first to rate how firmly established the quality program was at their mill. The rating was on a scale from one (almost nonexistent) to five (well established). The first chart in Figure 2 indicates that most respondents feel their program is fairly well established, even though most programs are relatively new—66% rated their mills as three, four, or five, and the largest rating (31%) was three, indicating only medium involvement, so far, by mills.

Respondents were then asked to rate the commitment of mill management to the program. Responses indicate a positive reaction from management, with 55% ranking commitment as a four or five (second chart of Figure 2). Very few mills (6%) ranked management commitment as very low.

In analyzing whether some manufacturers put more emphasis on quality than others because of the grade produced, the survey showed that the level of quality programs mostly depends on the mill or company. Printing/writing and specialty grades seem to put no more emphasis on quality than linerboard, containerboard, or corrugating medium. Even newsprint manufacturers, supposedly pushed by demands for higher brightness and better printability, did not necessarily have quality programs firmly established in their mills.

Many quality gurus say that one of the first steps in implementing a quality system is to adopt a written quality policy or statement. These statements are exemplified in slogans from such companies as Ford Motor

FIGURE 3: **Of the 35% of mills that have developed their own quality manual, most kept them site specific by handling in-house only.**



Co. ("Quality is Job 1"). Pulp and paper mills are fairly divided on how important a policy can be—48% said they have a written quality policy.

Because most mills are in the early stages of program development, only 35% said they have a written quality manual to guide their efforts. Figure 3 gives a breakdown of how those manuals were developed—76% by the mills, 6% by consultants, and 18% by mill/consultant teams.

One of the most telling signs of how far program implementation has progressed in mills is how involved mill operators are in the quality program (Figure 4). An overwhelming number of respondents (88%) rated operator involvement as "very important" (five on a scale of one to five). Another 10% rated it as "highly important" (a four rating). No mills rated the importance of operator involvement below a three.

But when asked to rate how involved their own mill operators are in the program, 45% rated it as only medium involvement (three) and 34% rated it as "limited involvement" or "slight involvement" (one or two).

QUALITY TOOLS AND PROGRAM EMPHASIS. As stated earlier, quality control takes different forms at different mills. The term "quality control" now means an emphasis on controlling and improving the process of pulping and papermaking. As part of their quality programs, mills are adding new and necessary tools to track raw material and machinery consistency. But this shift in emphasis is not replacing the final-product testing and inspection that has always been the industry's quality control.

End-product testing is used by 96% of the responding mills as a method for determining quality. However, newer, more advanced quality tools—vendor certification, SPC/SQC, etc.—are becoming standard practice in many mills, complementing the methods already in place (Figure 5). Some of the methods listed under the

Quality leaders

Competition is a driving force in all industries, and industry leaders set the standards for which others will strive. This is also true in quality control, but manufacturers in other industries also have set the example for many pulp and paper companies to develop quality control systems. The survey asked respondents first to name some of the quality leaders within the pulp and paper industry and then to name some quality leaders outside the industry.

Pulp and paper quality leaders:

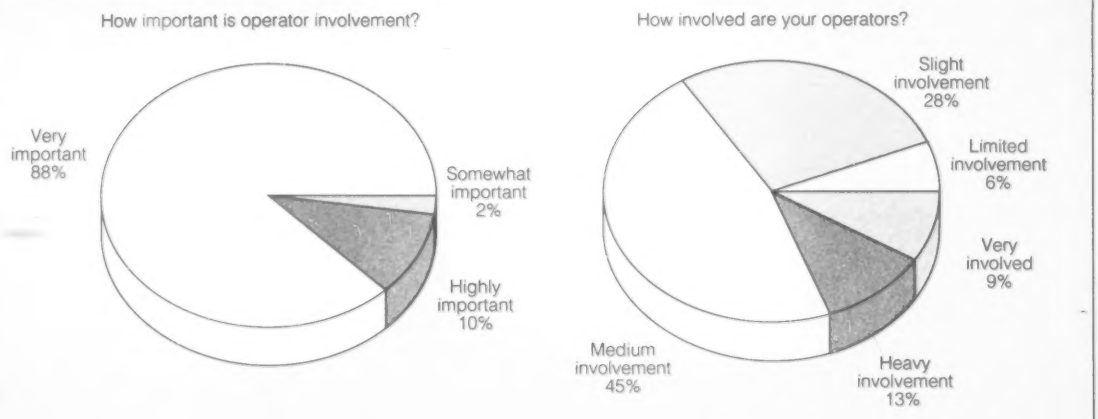
Champion International
Consolidated Papers Inc.
Daishowa Inc.
Dexter Corp.
Hammermill Papers
James River Corp.
Jefferson Smurfit Corp.
Kimberly-Clark Corp.
Kruger Inc.
Mead Corp.
North Pacific Paper Corp.
Packaging Corp. of America
Procter & Gamble Corp.
Repap Enterprises Corp. Inc.
S.D. Warren Co.
Union Camp Corp.
Westvaco Corp.
Weyerhaeuser Co.

Other quality leaders:

3M
Air Products
Allen-Bradley
AT&T
B.F. Goodrich
Black & Decker
Browning Arms & Sporting Goods
Cadillac[1]
Cargill
Dow
Dunlop Tires
Du pont
Engelhard
Federal Express[1]
Ford
General Electric
General Motors
Harley Davidson
Hewlett Packard
Honda
IBM[1]
J.M. Huber
Kodak
London Fog
Lorentzen & Wettre
Martin Marietta
Milliken[1]
Motorola[1]
Nalco
Nissan
Rohm & Haas
See's Candies
Supra Boats
Tennessee Eastman
Toyota
Wal-Mart
Westinghouse Nuclear Fuels Div.[1]
Xerox Corp.[1]

1. Indicates Malcolm Baldrige National Quality Award winners.

FIGURE 4: **Operator involvement in the quality program ranks as very important with an overwhelming majority of mills, but those mills are struggling to get their operators into the program.**



Quality control reading list

Survey respondents listed numerous books and reading materials that aided them in guiding their quality control efforts. The following is a reading list of those books that are still in print, and many can be found in local libraries or bookstores.

Amsden, Robert T., et al., *SPC Simplified,* Quality Resources: White Plains, N.Y., 1986.

Aubrey, Charles A. II and Felkins, Patricia K., *Teamwork: Involving People in Quality and Productivity Improvement,* Quality Resources: White Plains, N.Y., 1988.

Bird, Frank E. Jr. and Germain, George L., *Commitment,* Institute Publishing, a div. of International Loss Control Institute: Loganville, Ga., 1988.

Box, George E. and Draper, Norman R., *Evolutionary Operation: A Statistical Method for Process Improvement,* John Wiley & Sons: New York, N.Y., 1969.

Chase, R.S., editor, *Total Quality Management,* Springer-Verlag: New York, N.Y., 1988.

Crosby, Philip B., *Quality Without Tears: The Art of Hassle-Free Management,* New American Library: New York, N.Y., 1985.

Daniels, Aubrey C. and Rosen, Theodore A., *Performance Management: Improving Quality and Productivity Through Positive Reinforcement,* Performance Management Publ.: Tucker, Ga., 1983.

Deming, W.E., *Quality, Productivity, and Competitive Position,* MIT, Center for Advanced Engineering Study: Cambridge, Mass., 1982.

Deming, W.E., *Out of the Crisis,* MIT, Center for Advanced Engineering Study: Cambridge, Mass., 1986.

Ernst & Whinney Quality Improvement Consulting Group Staff, *Total Quality: An Executive's Guide for the 1990s,* Dow Jones-Irwin: Homewood, Ill., 1989.

Feigenbaum, Armand V., *Total Quality Control,* 3rd ed., McGraw-Hill: New York, N.Y., 1983.

Gitlow, et al., *Tools and Methods for the Improvement of Quality,* Richard D. Irwin Inc.: Homewood, Ill., 1988.

Gitlow, H.S. and Gitlow, S.J., *The Deming Guide to Achieving Quality and Competitive Postion,* Prentice Hall: Englewood Cliffs, N.J., 1986.

Goldratt, Eliyahu M. and Cox, Jeff, *The Goal: A Process of Ongoing Improvement,* North River Press: Croton-on-Hudson, N.Y., 1987.

Grant, Eugene L., and Leavenworth, Richard S., *Statistical Quality Control,* 5th ed., McGraw-Hill: New York, N.Y., 1980.

Guaspari, John, *The Customer Connection: Quality for the Rest of Us,* AMACOM: New York, N.Y., 1988.

Imai, Masaaki, *Kaizen: Key to Japan,* McGraw-Hill: New York, N.Y., 1989.

Ishikawa, Dr. Kaoru, *Guide to Quality Control,* 2nd ed., Quality Resources: White Plains, N.Y., 1986.

Juran, J.M., editor, *Quality Control Handboook,* 4th ed., McGraw-Hill: New York, N.Y., 1988.

Oakland, J.S., editor, *Total Quality Management,* Springer-Verlag: New York, N.Y., 1990.

Peters, Thomas J. and Waterman, Robert H. Jr., *In Search of Excellence: Lessons from America's Best Run Companies,* Warner Books: New York, N.Y., 1988.

Peters, Tom, *Thriving on Chaos: Handbook for a Management Revolution,* Harper & Row: New York, N.Y., 1988.

Rogers, Buck and Levey, Irv., *Getting the Best Out of Yourself and Others,* Harper & Row: New York, N.Y., 1988.

Scherkenbach, W.W., *The Deming Route to Quality and Productivity: Road Maps and Roadblocks,* CeePress Books: Washington, D.C., 1986.

Scholtes, Peter R., *Team Handbook: How to Use Teams to Improve Quality,* 2nd ed., Joiner Assoc.: Madison, Wis., 1988.

Wheeler, Donald J. and Chambers, David S., *Understanding Statistical Process Control,* Statistical Process Controls Inc.: Knoxville, Tenn., 1986.

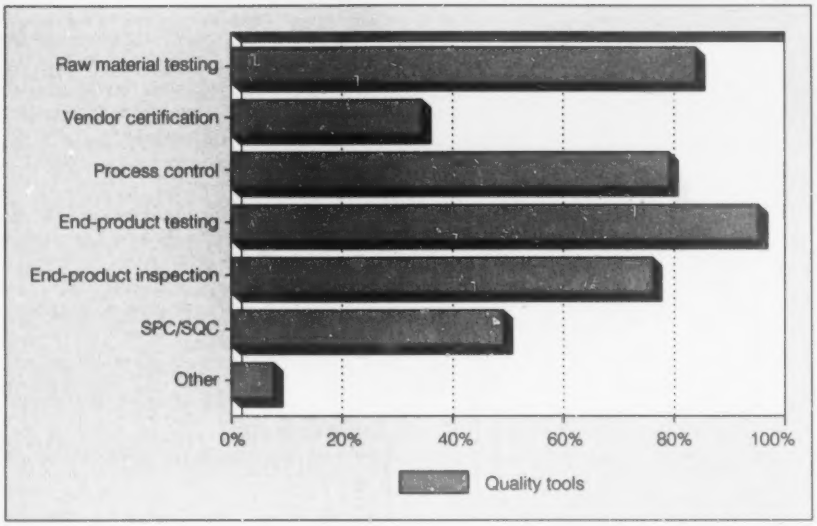


FIGURE 5: **Various tools or methods are available for mills to use in their quality programs. While almost all continue to use end-product testing, advanced methods such as vendor certification and SPC/SQC are making their way into mills.**

"other" category include daily, monthly, quarterly, and year-end trends and summaries; process tracking; customer/supplier teams; and designed experiments.

Control charts, usually associated with SPC/SQC programs, are said to be one of the best ways of involving mill operators in the quality program. Some mills believe that having the operators plot the charts manually gives those operators insight into the process; other mills have turned the function over to their process automation systems, equipped with special software, to plot the charts. The survey shows that 25% of the responding mills chart manually, 11% use an automated method, and 31% use both methods. The other 33% do not employ control charts.

Process automation plays a fairly dominant role in mills' quality programs—based on a scale of one to five, 76% rated process automation "fairly important" to "very important" (three to five) to their quality control programs. Only 20% rated process automation very low (one or two); 4% didn't answer.

With the implementation of quality programs, mills constantly search for sources to help them refine their efforts and keep them up to date on the latest quality control methods. Figure 6 shows that conferences (77%)

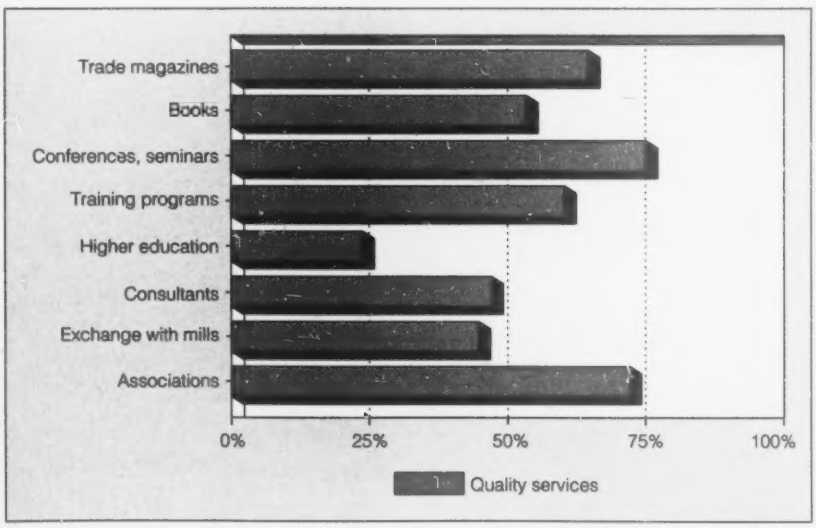


FIGURE 6: **Conferences, seminars, and associations lead as sources of information for mills' quality programs, along with trade magazines and training programs.**

and associations (74%) are important sources, as are trade magazines (66%) and training programs (62%). Books also are a top priority for guiding quality programs (see "Quality control reading list" sidebar).

When asked what process areas mills had focused their quality control programs on, respondents named numerous specific projects in almost every area of the pulp and papermaking process, including the following:

- Woodyard: purchased chip quality, chip variability, chip uniformity to digesters
- Pulp mill and bleach plant: washing and digester processes, reduced variation in white liquor, screening and cleaning stages, kappa number variation, pulp brightness, pulp viscosity
- Chemical recovery: lime kiln operation, causticizing efficiency for uniformity of white liquor, green liquor variation, black liquor solids control
- Paper machine: moisture profile control, formation, sheet stability, sheet strength, online freeness, first pass retention, caliper control, sheet cleanliness, cross-direction (CD) and machine-direction (MD) variation, size press uniformity, and pickup
- Coating: color control, coating makeup systems, starch solids control
- Finishing/shipping: roll arrival condition, slitting and trimming, roll quality inspections, reduced number of offset cores, winder operation
- Environmental: Sewer loss control, management of water use.

Respondents were also asked what process areas would most benefit from quality control programs. Many of the respondents said all areas would benefit, and most of the areas mentioned above were also listed. Others areas named include the repulper, secondary fiber processing, paper machine dry end, paper machine additive control, incoming wastepaper quality, and control of wet-end chemistry.

FOLLOWING THE QUALITY CHAIN. Quality improvement is customer driven, as evidenced by the changes in the U.S. automobile industry in reaction to foreign automobiles grabbing a large share of the U.S. market. Therefore, in almost all industries a quality chain exists where customers pass down demand for quality. The survey shows that such a chain has begun in the pulp and paper industry.

Asked if their customers require quality data with final shipments, 17% said yes, 6% said no, and 77% said it depends on the customer. When asked if their customers required the company to have some type of quality program, a surprising 42% said they did (first chart in Figure 7).

Meetings are normally an important part of the quality exchanges between customer and supplier. Almost all of the respondents said meetings depend on the customer. Most of the mills meet either annually (25%) or quarterly (25%) with their customers, and 15% said they meet monthly. Others responded that mill/customer meetings occurred biannually. With key customers, some held meetings weekly, and one mill said that it meets only for problem solving while another said "when there are complaints."

On the mill-to-supplier side, 69% of the respondents said they require quality data on raw material shipments from their suppliers, although some said it depends on the supplier or the product. But unlike the customer-to-mill demand of a specific quality program, only 27% required a quality program from their suppliers (second chart in Figure 7).

Mills also seem to be less demanding on meetings about the quality of raw materials from their suppliers. The largest number of respondents (38%) said meetings depend on the supplier, 25% said they meet quarterly, 15% said they meet annually, and 12% said they meet monthly. ■

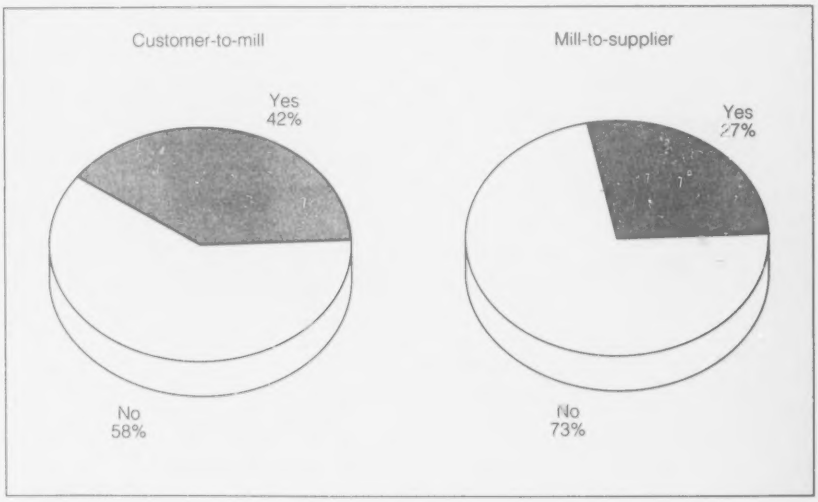


FIGURE 7: **Tracking the quality chain shows that more customers are demanding mills to have some type of quality control program (customer to mill), while mills are just beginning to pass this demand on to their suppliers (mill to supplier).**

Managers comment on quality

Respondents to the *P&P* survey had numerous comments on the state of quality control in the pulp and paper industry. Some had comments about their own specific problems with establishing "quality thinking" at both the management level and the operator level. Others pointed out how far behind they thought the pulp and paper industry was in their implementation of quality control programs. The following are some of the opinions they expressed.

"1.) Let's join the modern world and view paper as an engineered structure rather than a commodity. 2.) Quality managers—both at the local and corporate levels—should be given more authority in the hierarchy rather than [be seen as] a 'necessary evil' or 'defect police.' 3.) Since we are driven by customers' quality demands, we should actively insist on vendor-certification programs. 4.) Off-machine (finished product) testing should become passe if our industry is willing to practice true "real time" SPC/SQC. 5.) There is a sincere frustration of quality control people being caught in the crossfire between the mill, the customer, and the operators. You will never please all (sometimes none) of the people involved. If you have all three groups mildly irritated at you, it could be said that you're doing an excellent job. Quality people tend to be called in after the fact to 'put out the fire.' Involvement should be from the chip pile through the finished product, then followed up with outstanding customer service."

—Quality control supervisor
Corrugating medium and sack kraft mill
Northwest

"We, as an industry, must continue to expand our formal focus on quality to meet the challenge of the 1990s."

—SPC manager
Printing/writing and specialty paper mill
Southeast

"The paper industry is using more quality systems and processes than its leaders recognize. Many of these have been limited to manufacturing. We need to expand this to a company-wide attitude."

—Technical director
Printing/writing paper mill
Midwest

"The first paper company that does TQM right will put itself so far ahead of its competitors, that they will never be caught."

—Manager of total quality
Coated and uncoated groundwood mill
Northeast

"I think quality is becoming a new buzz word. Unfortunately, many companies are initiating programs, instead of truly integrating quality management concepts into their everyday way of doing business."

—Coordinator
Printing/writing paper mill
Southeast

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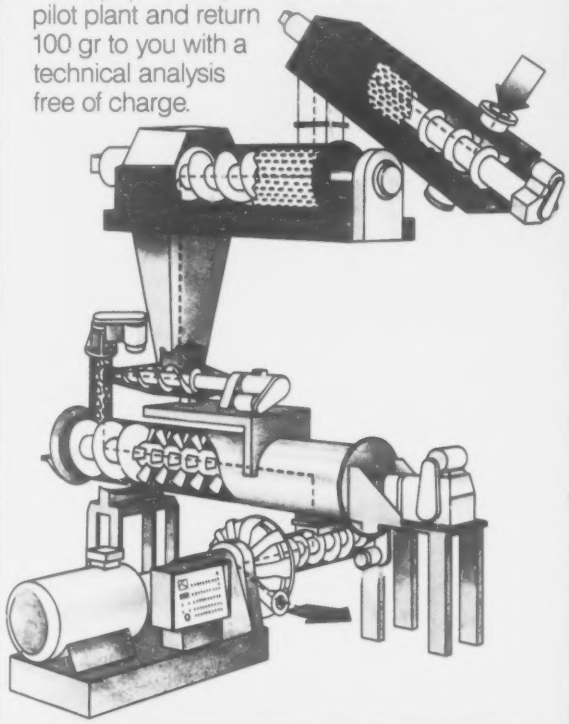

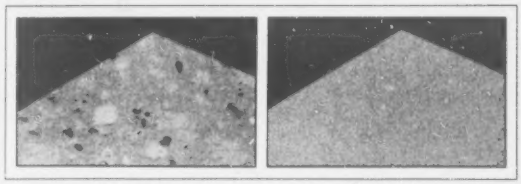

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Advanced Controls Can Help Mills Stay Competitive During Downturn

Pulp and paper companies that didn't expand in prosperous times will need technological edge to battle foreign competition, tight market

By ANN DAMIANO

The North American pulp and paper industry has recently experienced a downturn, and the market is not expected to begin recovering until mid-1992, according to many industry observers. This is partially due to increased capacity recently brought online. Such large capacity expansions were financed by high profits in the industry during the last several years.

For the next decade the pulp and paper process automation market will require a different mix of hardware, software, and services. Mills that did not originally participate in the capacity increase phase of the business cycle in the 1980s will have to find new ways to regain competitive advantage. If they do not, they face being squeezed out of what is rapidly becoming a very tight market.

To combat this problem, mills must reduce operating costs and improve product quality. One of the best and least-used methods to do this is to implement advanced controls, such as product controls, process modeling, expert systems, scheduling algorithms, and statistical quality control, designed to enhance manufacturing competitiveness throughout the mill.

INDUSTRY ANALYSIS. Since the end of World War II there have been eight complete business cycles in the U.S. economy. Expansion periods of these cycles have averaged 45 months, with the shortest lasting 12 months and the longest enduring for 106 months. Contractions in the economy have averaged 11 months and have ranged from six to 16 months in duration. Now, after eight years of expansion, the U.S. economy has slid into a downturn.

The good news is that all recessions end. DRI/McGraw-Hill predicts the recession will be mild and expects it to resemble the 1960 and 1970 recessions. This would be characterized by a peak-to-trough decline in gross national product (GNP) of about 1% and a 2% rise in unemployment. If this downturn bottoms out in spring 1991, the duration will be near the postwar average of 11 months.[1] Risks to this forecast come from the Middle East crisis and oil markets. If war brings skyrocketing oil prices, the result will be a deeper, longer recession, coupled with higher inflation rates.

Paul J. Waters, a Cahners Economics' economist who monitors the pulp and paper industry, explains that the current downturn is very psychological in nature. "This is a confidence recession; people are scared and, consequently, not willing to spend money." He says that the pulp and paper industry is one of the more healthy manufacturing sectors. Nonetheless, it has been very hard hit by the savings and loan disaster, the credit crunch resulting in a slowdown in investments, and high interest rates due in part to the Middle East crisis.[2]

In November 1990, consumer confidence fell to its lowest level since the 1982 recession. The consumer-demand sector is two-thirds of the economy's GNP. Most of this loss in confidence reflects consumers' lowered expectations of future economic conditions. As consumers ponder the Middle East war, tax hikes, and the recession, they will continue to be reluctant to open their wallets.

The current recession is different from earlier ones since a new and very powerful factor is at work—offshore competition. While worldwide growth is slowing, economies of Europe and the Pacific Rim are expected to grow at a satisfactory rate. Since there is a dissociation between U.S. and foreign capital spending, this could lead to large overseas competitors using this downturn to hammer weakened American companies.

During the 1980s, many U.S. companies restructured and shed much of their "fat." Consequently, mass layoffs and drastic cost-cutting measures are simply not feasible as an antidote to fight this recession. Brian Dumaine, in his article "How to Manage in a Recession," says that companies will need to devise ingenious ways to squeeze money out of margins, including looking at the way people go about their work, new administrative

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systems, and investments in technology. Instead of cutbacks across the board, companies must make strategic investments in their business to keep up with global competition. Battening down the hatches and trying to ride out the downturn simply will not work this time. If American companies do not continue to invest, they will find that emboldened foreign competitors meanwhile will have launched new products, cut prices, boosted advertising, and stolen market share that will be extremely difficult to recover.[3]

The U.S. pulp and paper industry is susceptible, as are other industries, to the previous scenario due to increased offshore competition in its market. For instance, U.S. producers are fortunate to have ample fiber resources available to supply their mills. They have not been forced, until the last several years, to make investments in efficient material use as have their foreign competitors. Now, to keep pace with the global market, the industry must continue to streamline business and process operations.

It appears that the pulp and paper industry's health parallels the economy in general. Before this current downturn, the industry experienced eight earnings declines in the last 30 years. Four of these downturns occurred during times of decline in real GNP. Of the remaining four declines, one saw the dollar at the highest level in decades. Therefore, in the last 30 years, there have only been three occasions when the pulp and paper industry's earnings have fallen without a general recession.

While a recessionary scenario in the U.S. economy is a problem, it is not the primary one. The current earnings decline in the market is caused by a deterioration in supply-and-demand conditions brought on primarily by excessive capacity expansion and now exacerbated by a sluggish U.S. economy. The industry now faces higher operating costs and falling demand. Higher operating costs were often associated with bringing new capacity online, and shrinking demand can be tied directly to economic woes.[4]

Thomas F. Murphy, director of pulp and paper marketing at Honeywell, says, "It is important for those mills that did not take part in the capacity expansion to modernize while profits in the cycle are still high enough to support the investment. Without it, a firm can find itself with higher production costs and lower competitive quality when a shakeout occurs and forces marginal performers out of the market."[5]

Net income for the industry reached its peak in first-quarter 1989 and stayed there for two more quarters before declining in the fourth. The peaking of industry income was related to the slowing economy but was not the primary reason. It had much more to do with the capital cycle of the pulp and paper industry and the fact that supply and demand conditions had begun to deteriorate as part of the business cycle.

After the 1981-82 recession came to a close, the economy began an eight-year expansion. Profits began to rise. Using these profits, the industry embarked on a major capacity expansion to support strong demand and high prices for its products. With strong consumer spending leading the way, the industry was able to finance huge mill expansions and deal with the increasing pressure on environmental control.

INDUSTRY CAPITAL SPENDING TO FALL. During the last five years, the industry has more than doubled capital investments. From a long-term perspective, a modest dip is expected in the next several years before recovering by the middle of the decade. The focus of the spending, in the short term, will shift from capacity expansion to environmental control.

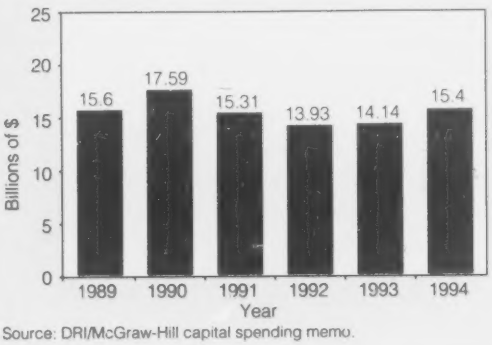
Pulp and paper producers spent at record levels in 1990, with expenditures reaching $17.6 billion. DRI/McGraw-Hill explains what will happen to pulp and paper spending in the near future. "Capital spending will undergo a sharp cycle during the next several years: down sharply in the next two years and then up significantly in 1994-95." The resulting 1.5% average investment increase is in addition to the high level of investments made in 1988 and 1989. Despite a 1.8% growth in annual output, this will push the pulp and paper industry's capacity utilization rate down more than 15 percentage points between 1989 and 1995 (Figure 1).[6] Producers will be under enormous pressure to control costs if they expect to participate in this highly competitive global market.

According to a study done by Cahners Economics, the pulp and paper industry will be the manufacturing sector fourth hardest hit by the new Clean Air Act pollution control regulations. When the new law goes into effect, the industry will be forced to spend approximately $2.8 billion in about three years to comply (Figure 2). This includes $1.3 billion for maintenance and repair on operations plus $1.5 billion for new capital equipment. These figures are discounted over three years. In the face of already declining capital spending, the industry must earmark a sizable part of its available capital to comply with government regulations. Fewer funds are then available for major capital projects.

RESTRUCTURING ABOUNDS. It is evident that the market is restructuring itself. Companies are buying and selling timberland, mills, converting plants, and entire divisions. They are taking a hard look at their operations and asking themselves fundamental questions such as "What is the business we want to be in?" James River Corp., for example, recently announced a sweeping restructuring of its operations. The company plans to sell off some 30 mills and concentrate on four core businesses. It will also expand its operations in Europe, where it operates two joint ventures with European companies.

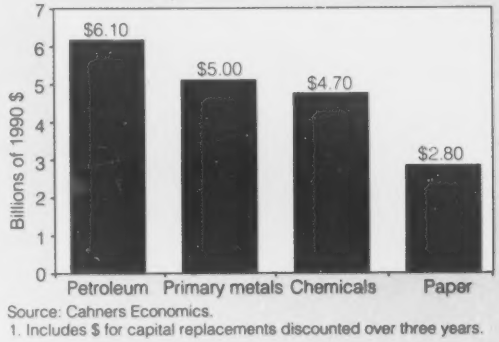
Boise Cascade Corp. said that it will reduce its presence in the Northwest pulp and paper market and concentrate on white paper, office products distribution, and building products. Georgia-Pacific Corp. plans to

FIGURE 1: **Pulp and paper industry capital expenditures.**



Source: DRI/McGraw-Hill capital spending memo.

FIGURE 2: **Clean Air Act expenditures (billions of 1990 dollars).**



Source: Cahners Economics.
1. Includes $ for capital replacements discounted over three years.

sell off nearly $1 billion in assets to reduce the debt load from its acquisition of Great Northern Nekoosa.

Smart firms have realized that with the increasing competitiveness of the marketplace, they must be sleek and efficient to compete in tomorrow's global market. Some companies mentioned have already taken steps to accomplish these goals by consolidating operations and reducing debt in their capital structure. Companies can also combat the downturn by reducing operating costs and improving product quality without massive capital expenditures. A key tactic is implementing advanced controls as a strategy to improve mill operations.

IMPACT OF ADVANCED CONTROLS IN THE MILL. The return on investment (ROI) for advanced controls is generally ten to 15 times higher than for hardware expenditures. ROI on advanced controls projects can range from 50% to 100%. This is significant when the criteria for justifying a project have become more stringent. Paybacks on these types of projects are generally within one year on the upside and two years on the downside, crucial when jittery stockholders are looking for immediate results.

For purposes of this article, the following definition of advanced controls will be used, provided by Michael T. Brown, pulping application consultant for Honeywell: "Advanced controls are higher-level controls based on modeling, special algorithms, and statistical quality control, among others. They reside above and coordinate lower-level regulatory control (e.g., flow, temperature, and pressure) to achieve an operational objective (e.g., reduce kappa number variation)."[7]

Michael F. Saucier, president of Process & Instrumentation Diagnostics, explains that the use of advanced control technology can enable a mill to maximize the performance of an existing control system. "When a distributed control system is first installed, it may take some time to get the system up and running to the customer's satisfaction. From that point on, the performance of the system will deteriorate over time unless periodic system surveys are done and the system is fine-tuned. These tunings will keep the system at the same or slightly higher levels of functionality, due to the learning curve on the system and of the process."

However, an even higher level of system performance can be achieved through the implementation of advanced controls (Figure 3). Advanced control solutions allow users to extract maximum performance from the control system without excessive capital expenditures.[8]

Advanced controls enable a mill to achieve optimum performance from existing technology and feature the flexibility to be modified or expanded as new technology evolves. There are a great number of opportunities for increased efficiency and cost savings in the mill.

The pulp mill has excellent potential for cost savings and improved quality using advanced control solutions. The primary objectives for advanced controls in the pulp mill are to maximize production, minimize costs, and produce a uniform-quality product. Pulping costs are increasing for several reasons:

- Increased competition for and restrictions on wood supply (e.g., spotted owl controversy)
- Process changes for dioxin formation reduction
- Greater ratio of recycled fiber to virgin fiber due to increased government regulations.

Also, there is a move to a "just-in-time" (JIT) manufacturing environment in the pulp and paper industry. The producer must be able to switch between grades while maintaining coordinated production modifications that will require increased manufacturing flexibility throughout the mill.

Kamyr continuous and batch digester control-optimization packages are available that, when used with basic regulatory control, enable the pulp mill to stabilize digester operations, improve product quality and uniformity, and reduce cooking costs. The following figures are estimates of some reductions/savings that can be achieved. A site analysis would confirm potential savings by comparing current levels of control in use at a particular site. The intent is to offer an idea of the var-

ious areas where savings can be realized.

In the continuous-digester process area of the mill, there is potential for the following reductions:

- Decreased K/Kappa variation (20%)—potential for improved downstream operations and K/Kappa target shift
- Increased pulp yield (1% additional)—increase in dollar savings, since there is less wood going into the digester and more pulp production
- Decreased steam consumption (5%)—savings in terms of lb of steam/air-dry (a.d.) ton of pulp
- Increased washing efficiency—higher black liquor solids (2%) and less alkali carryover
- Decreased white liquor use (5%)—partially due to tighter liquor-to-wood and chemical-to-wood control.

Other savings can result from decreased downtime of the digester as well as increased efficiency from operators due to better visibility of the process.

In a batch digester facility, the implementation of an advanced control solution can result in the following savings:

- Decreased K/Kappa variation (30%)—provides both smooth operation and the capability to shift the target to reduce cooking costs
- Increased overall pulp production (1.5% to 5%)—resulting from better charging methods and more advanced production scheduling controls
- Increased pulp yield (0.5% to 1.5%)—due to improved charging and cooking controls
- Reduced steam demand (10%)—as measured in lb/a.d. ton of pulp
- Reduced steam flow variation (25% to 60%)—as measured by peak-to-peak variation.

In addition, the use of advanced controls in the batch digester process area can reduce the solids load to the recovery plant. The improved production control eases coordination with the boiler house, resulting in lower steam demand and reduced steam consumption. An efficient controls package will also result in better utilization of the labor force.

Mills that have implemented advanced controls in the bleach plant have realized savings in the range of $500,000 to $750,000/year. This comes from reduced use of the expensive chemicals needed in the bleaching process and improved product quality. Benefits to implementing advanced controls in the bleach plant follow:

- Reduction of off-specification pulp
- More on-target brightness of pulp
- Higher and more uniform pulp strength
- Reduced bleaching costs
- Lower effluent costs
- Reduced raw materials use.

Examples of reductions that can be achieved are as follows:

- CE kappa number—reductions of up to 40% have been realized in CEK variability. This means additional chemical cost savings, such as hypochlorite, and reduced variability in the final brightness of the pulp.
- Bleaching chemicals use—reductions of 5% in chlorine use and 9% in chlorine dioxide use.

The bleach plant has been the focus of increased environmental control. Many mills are modifying their processes to comply with new governmental regulations. In the future, advanced controls will enable mills to have better control over environmental parameters, such as kappa factor, defined as the following:[9]

$$kf = \frac{\%\ \text{total equivalent chlorine applied to stock}}{\text{kappa number}}$$

In addition, the use of advanced control solutions in the bleach plant will allow the mill to minimize off-specification pulp during production rate changes and grade changes.

Improvements can also be realized in the lime kiln. These include maintaining stable lime kiln hot-end temperature by controlling ID fan, fuel, primary air, production rate changes, and kiln speed. Features of such systems include constant cold-end temperature and overall kiln profile control, minimum O_2 level control, acceptable total reduced sulfur (TRS) emissions control, and protection of refractory material from high-temperature excursions.

In the paper machine area, packages are available that control the ratio of dry fiber furnish and chemical addition in paper machine stock. There are also machine-direction and cross-direction controls for basis weight, moisture, and caliper. Benefits include reduced blend variability, quick grade change, reduced off-specification paper, improved broke utilization, higher reliability, and production monitoring.

WHAT TO LOOK FOR IN A SUPPLIER. In evaluating a vendor from whom to purchase advanced controls, several factors should be considered. It must be determined if the package can be customized to fit a currently installed system and if more features and functions can be added later. Using one source for distributed and advanced controls can further reduce costs as well as provide complete accountability, supplier loyalty, and a better product.

Saucier says that one of the most important advantages of advanced controls is that the performance of the software can be documented and guaranteed. "You should demand a performance guarantee from a supplier, and if they are unable or unwilling to provide one, then you should find another vendor." The use of advanced control technology in process automation systems is a relatively small expenditure and, when combined with a guarantee, removes the risk from the investment. In making an evaluation, a vendor should work with a mill and provide the following important services:

- Identify customer needs: The advanced control supplier should work with the mill to help evaluate what needs to be done and identify a preliminary scope of work to be performed.

• Provide presale support: At this stage, the vendor should work with the mill to more fully define the solution to its problem. This entails feasibility studies, cost/benefit analysis, and assistance in defining system specifications. To help justify the project to mill management, the vendor must be able to show projected savings in each process area slated for advanced controls.

• System design: The system requirements should be mutually agreed upon. The system must be customized to fit the specific needs of the process.

• Design implementation: The vendor should provide comprehensive project implementation and installation services resulting in a high-quality system that meets the requirements identified in the system design phase of the project.

• Project installation: During installation, the software and any special hardware are installed in the mill and integrated with other systems as required.

• Customer acceptance: The project is not complete until both the mill and the supplier agree that the acceptance criteria have been met.

• Project follow-up: The custom solution supplied to the mill should be fully supported by the advanced control supplier, including warranty.

• Results report: If the mill desires, the vendor should be willing and able, after the system is installed and on control, to perform a postproject audit.

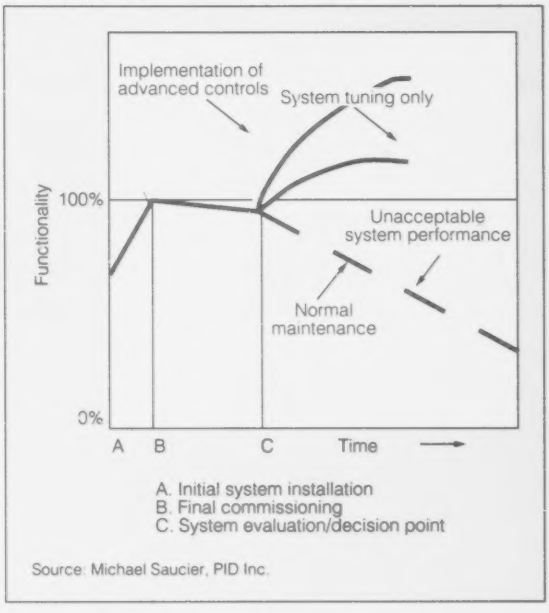
Finally, successful implementation of an advanced control solution is a function of people as much as a function of the package. The supplier must understand both the mill's process and business goals. The use of advanced controls is important when the pulp and paper industry has generally seen a reduction in engineering technical staff. This is especially surprising since it has occurred during a time of rapidly changing process and automation technology.

A supplier must have more than one expert in any one process area, and asking for résumés is not uncalled for. Extensive experience in the pulp and paper industry is necessary so the vendor can work as a partner with a mill to help it achieve objectives.

Relationships between pulp and paper producers and suppliers have been evolving during the last several years. The industry has been moving toward establishing relationships with suppliers of vital resources because of the increased demand for a high-quality product. This is especially true of intellectual resources. Consequently, producers can increase the responsibility and accountability of their suppliers and, in turn, better meet the needs of their customers.

Markos I. Tambakeras, vice president of Honeywell's Industrial Automation Systems Business, explains this shift in philosophy. "The evolution of advanced control technologies has driven pulp and paper companies to view differently not only their use of technology but also the suppliers of new technologies. Advanced controls become a strategic weapon, and partnership becomes the only way to guarantee the successful use of that weapon."[10]

FIGURE 3: **By implementing advanced controls, a higher-than-normal level of system performance can be achieved.**



Source: Michael Saucier, PID Inc.

As the industry moves through the business cycle, those who make strategic investments will have a competitive advantage over those who do not. The implementation of advanced controls is a proactive way to capitalize on the current recession. Advanced control solutions are a key business strategy to lower costs and improve product quality during times of reduced capital availability.

A recession can be the time to take advantage of weakened competitors and to seize market share. Advanced control technology enables manufacturers to improve their manufacturing competitiveness now and, in turn, be better prepared for the next expansion. ■

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